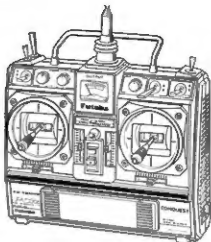


Futaba®

DIGITAL PROPORTIONAL
RADIO CONTROL

PCM



INSTRUCTION MANUAL

FP-6NHP 6 CHANNELS FOR HELICOPTER



FUTABA CORPORATION OF AMERICA
FUTABA CORPORATION

D60402

*Thank you for purchasing a Futaba digital proportional radio control set.
Please read this manual carefully before using your set.*

FEATURES

The PCM FP-6NHP is a 6 channel PCM proportional radio control set for helicopters the transmitter has been re-designed in pursuit of easier operation, as well as newly designed sticks for smooth and positive operation. This PCM system feature servo hold & fail safe function, servo reversing switches, aileron and elevator dual rate, throttle hold, pitch control trim, idle up, high & low pitch curve trimmer, and other innovations based on the opinions of many RC helicopter modelers.

TRANSMITTER FP-6NHP

- An inverted flight ON/OFF switch is provided. The pitch control, elevator, and rudder servos are reversed for inverted flight when this switch is set to ON, inverted flight is then extremely easy.
- Reliability substantially improved by assembly of the PC board by industrial robot.
- Servo reversing switch. Servos are reversed by switching this switch.
- Aileron and elevator dual rate function. Steering angle can be arbitrarily set by switch and trimmer.
- Easy-to-adjust two-knob revolution mixing. Throttle → pitch control → rudder mixing.
- Pitch control trim knob. Since a steering angle of about 30% of the pitch control servo can be trimmed, the best pitch can be set.
- Throttle hold switch and trimmer for auto rotation.
- Idle up switch and trimmer. Since the rotor speed can be held even when the pitch is lowered, more perfect maneuvers are possible.
- New one-chip microcomputer allows setting of the fail safe function with one touch. Development of an automatic transfer system eliminates setting of the fail safe function at each flight and improves safety.
- Built-in power arrear backup circuit. When the battery nears the completely discharged state, an LED flashes to indicate that the memory circuit (fail safe function) is not operating.
- High & low pitch curve trimmer. Since the high side and low side of the pitch curve can be adjusted to the best position, pitch direction operation is easier.
- Rate gyro output can be switched by channel 5 switch (GEAR CH5).
- Throttle ATL. Adjustable throttle limiter type throttle trim. Since the high side is not changed even when the slow side is adjusted, linkage is extremely convenient.
- Newly designed open gimbal sticks operate smoothly and positively. Adjustment mechanism allows adjustment of the operating feel of the stick lever.
- Non-slip adjustable lever head allows adjustment of the stick length as desired.
- RF PC board inside module system.
- Transmitter has been re-designed in pursuit of easier operation.
- Easy to read square transmitter battery voltage level meter.
- Excellent radiation efficiency, strong 8-stage telescoping antenna.
- Hook is provided as standard. Operation is easier if the transmitter is hung from your neck by using the optional neck strap.

RECEIVER FP-R116GP

- High performance and high reliability miniature PCM receiver. The perfect receiver for radio control achieved by the introduction

of the newest microcomputer technology.

- Miniature PCM receiver with built-in high-speed one-chip microcomputer. Extremely resistant to adjacent band and spark noise interference.
- Computer servo hold function eliminates operation when a dead point is passed, etc.
- Computer fail safe function and battery fail safe function improve safety substantially.
- Error lamp display allows checking of the receiver operating state.
- High sensitivity design with RF amplifier.
- Ultra narrow-band ceramic filter and PCM system increase resistance to adjacent band interference.
- Connectors use plated pins that completely eliminate poor contact. The plastic housing has been specially designed to aid in. Reliability against shock and vibration.

SERVO FP-S128/S130/S131S

- The S128 uses a skew motor. Even one trimming step is faithfully followed by a skew motor that displays a performance near that of a coreless motor. Since the output torque is 3.5 kg-cm (max), it can be used with almost all models. Operating speed is 0.24 sec/60°.
- The S130 is a small, waterproof servo using a high quality five pole motor. Operating torque is 4 kg-cm and operating speed is 0.24 sec/60°.
- The S131S is a high torque and high speed servo using the highest quality coreless motor. It is a 5 kg-cm operating torque, 0.22 sec/60° operating speed waterproof type.
- New indirect drive potentiometer improves vibration and shock resistance and neutral precision.
- Futaba low-power custom IC provides high starting torque, narrow dead band, and excellent trackability.
- Fiberglass reinforced PBT (polybutylene terephthalate) molded servo case is mechanically strong and invulnerable to glow fuel.
- Strong polycarbonate resin ultra-precision servo gear features smooth operation, positive neutral, and very little backlash.
- Fiberglass reinforced epoxy resin PC board with thru-the-hole plating improves servo amp vibration and shock resistance.
- Thick gold plated connector points ensure positive contact and improve reliability against shock and vibration. The housing is polarized to prevent reverse insertion.
- Special pad bushings simplify servo installation and have a high vibration damping effect.
- Six special adjustable splined horns.

SET CONTENTS AND RATINGS

(Specifications are subject to change without prior notice.)

	FP-6NHP
Transmitter	FP-6NHP x 1
Receiver	FP-R116GP x 1
Servo	FP-S128 x 4/S130 x 4/S131S x 4
Battery	NR-4J x 1
Switch	SW-J x 1
Others	Battery charger, Frequency flag, Spare horn, Mounting screw.

Transmitter FP-T6NHP

Operating system : Two-stick, 6 channels with servo reverse, aileron & elevator dual rate, helicopter functions
 Transmitting frequency : 72MHz band/50MHz, 63MHz band
 Modulation : PCM FM
 Power requirement : 6.0V NiCad battery (NT-SLP)
 Current drain : 250mA (at 6.0V)

Receiver FP-R116GP

Receiving frequency : 72MHz band/50MHz, 63MHz band
 Intermediate frequency : 455kHz
 Power requirement : 4.8V NiCad battery (shared with servo)
 Current drain : 24mA (4.8V reception)
 Size : $2.23 \times 1.05 \times 0.94$ in
 (57 x 42 x 24mm)
 Weight : 1.85 oz (52g)
 Receiving range : 500m on the ground
 1000m in the air
 (At the best radio wave condition of environment)

Servo FP-S128/5130/5131S

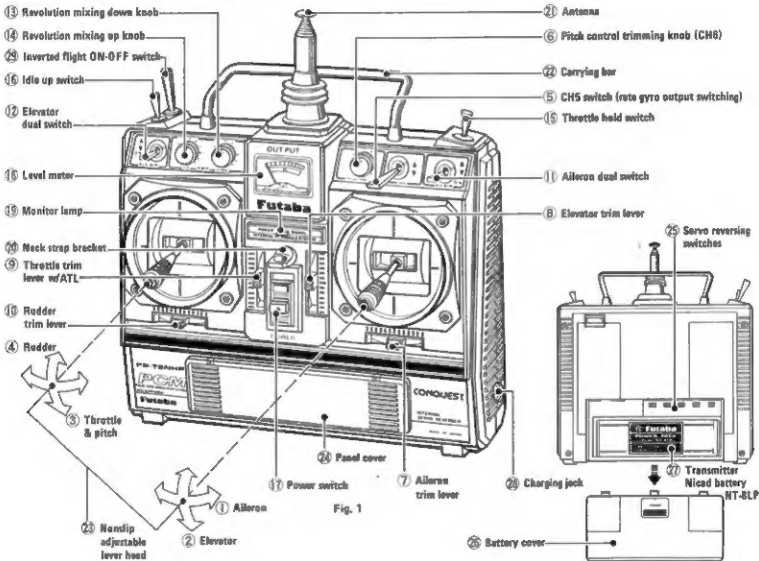
Control system : 4 pulse width control, 1.520uS
 Operating angle : One side 45° or greater (including trim)
 Power requirement : 4.8V to 6V
 Current drain : 6.0V 8mA (at idle) (FP-S128) (FP-S130) (FP-S131S)
 Output torque : 48.7 oz-in (3.5 kg-cm) : 55.6 oz-in (4 kg-cm) : 69.5 oz-in (5 kg-cm)
 Operating speed : 0.24 sec/60° : 0.24 sec/60° : 0.22 sec/60°
 Size : 1.59x0.76x1.59 in : 1.52x0.77x1.36 in : 1.59x0.79x1.39 in
 (40.5x20x40.5mm) (39.5x19.5x34.5mm) (40.5x20x38.5mm)
 Weight : 1.87 oz (53g) : 1.47 oz (42g) : 1.76 oz (50g)

Battery Charger FBC 8B(4)

Input voltage : 120VAC 60Hz
 Output : TX side 9.6V 50mA
 RX side 4.8V 50mA

Receiver Servo NiCad Battery NR-4J

Voltage : 4.8V 4/500mA.H
 Dimensions : $2.0 \times 2.28 \times 0.59$ in (51 x 58 x 15mm)
 Weight : 3.34 oz (95g)

TRANSMITTER FP-T6NHP CONTROLS**Fig. 1**

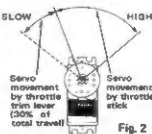
The servo reversing switches are assumed to be in the normal position in the description in this section. When the reversing switches are in the reverse position, servo operation is the opposite of that described here.

- 1 Aileron Aileron operation
- 2 Elevator Elevator operation
- 3 Throttle Throttle & pitch control operation
- 4 Rudder Rudder operation
- 5 CH5 switch (CH5) Rate gyro output switching or landing gear operation
- 6 Pitch control trim knob (CH6)

This is the pitch control servo fine adjustment knob. About 30% of the total servo travel can be adjusted and set. This knob is used in hovering and other fine adjustments.

- 7 Aileron trim lever Aileron trimmer.
- 8 Elevator trim lever Elevator trimmer.
- 9 Throttle trim lever with ATL

This is an adjustable throttle limit (ATL) type trim lever. It operates as a trim lever only when the throttle stick is at the SLOW side as shown in Fig. 2. This lever is extremely convenient during linking, etc. because the HIGH side of the throttle position does not change even if the SLOW side is adjusted.

**Fig. 2**

Throttle servo

Rudder trim lever

Aileron dual rate switch

This switch turns the aileron dual rate function on and off. The upper position is dual rate OFF and the lower position is dual rate ON. The steering angle is set with the trimmer (3) on the trimmer panel.

Elevator dual rate switch

This switch turns the elevator dual rate function on and off. The upper position is dual rate OFF and the lower position is dual rate ON. The steering angle is set with the trimmer (3) on the trimmer panel.

Revolution mixing down side ratchet knob (down side knob)

These knobs adjust the pitch control → rudder mixing amount. The mixing amount is approximately 0 to 70% at both the up side and down side. The mixing amount of the low side from the hovering position is adjusted with the down knob (13). (Hovering position is 1/2 throttle.) The mixing amount of the high side from the hovering position is adjusted with the up knob (14).

This is a mixing device for cancelling the reaction torque of the main rotor and is said to be the minimum mixing necessary for helicopter flight.

The function of the revolution up side knob (14) and revolution down side knob (13) from the throttle stick neutral position can be adjusted individually.

Throttle hold switch

When this switch is ON, the throttle servo stops at the position set at trimmer (2) on the trimmer panel and only the pitch servo is operated by the throttle stick. This is used at auto rotation dives. When this switch is OFF, the throttle and pitch control are mixed. The switch is turned on when pulled forward.

Idle-up switch

When this switch is pulled forward, it is turned on and the throttle servo maximum slow position is set to the position set at the idle-up trimmer (3) on the trimmer panel.

If the idle-up switch and throttle hold switch are turned on at the same time, the throttle hold switch has priority.

Power switch

The upper position is ON.

Level meter

This meter indicates the transmitter battery voltage.

Monitor lamp

When the power switch is set to ON, the monitor lamp lights and the level meter pointer deflects.

The monitor lamp goes out for a moment when the power switch is set to ON. This is because data is being transmitted. The lamp goes out once every 60 seconds so that the automatic transmission of the fail safe data can be monitored.

When switch (8) on the trimmer panel is set to ON and switch (9) is pressed, this lamp goes out and data transmission can be monitored.

When the battery nears complete discharge (when the transmitter battery is discharged), this lamp flashes to show that the fail safe memory circuit is not operating.

Hook

Metal hook for the optional neck strap.

Antenna Strong high load antenna. Extend the antenna to its full length when using the transmitter.

Carrying handle

Use this handle to carry the transmitter from place to place.

Non-slip adjustable lever head

The length of the lever head can be adjusted to fit the operator.

Adjust the length of the lever head to fit your hand before using the transmitter.

Unlock lever heads (A) and (B), by turning them in the arrow direction, and adjust the head to the most comfortable length and lock the heads by turning them in the direction opposite the arrow direction.

Panel cover To operate the trimmer panel switches and trimmers, open this cover as shown in the figure.

Open the cover by pulling it upwards.

Place your fingers here.

TRIMMER PANEL

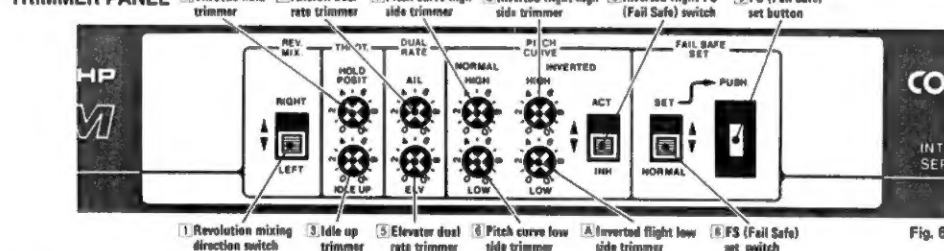


Fig. 6

1 Revolution mixing direction switch

When the main rotor rotates clockwise, set this switch to the RIGHT position. When the main rotor rotates counterclockwise, set this switch to the LEFT position. (The opposite may also be true, depending on the linkage.)

2 Throttle hold trimmer

This trimmer sets the throttle servo stop position when the throttle hold switch is set to ON. The total travel can be set.

3 Idle-up trimmer

This trimmer is effective when the idle-up switch is set to ON. It sets the throttle servo maximum slow position. The idle-up amount can be set as shown in the figure.

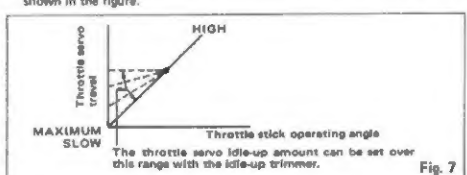


Fig. 7

4 Aileron dual rate trimmer

This trimmer adjusts the aileron travel when the aileron dual rate switch is set to the ON position. The aileron travel can be adjusted from 40% to 100% of the total travel. When the dual rate switch is set to ON, the servo throw can be set to an arbitrary angle smaller than when the dual rate switch is OFF (normal) as shown in the figure. Use the throw matched to the aircraft and the maneuvers to be performed.

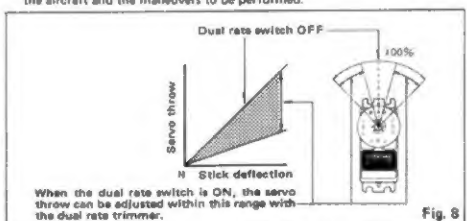


Fig. 8

5 Elevator dual rate trimmer

This trimmer sets the elevator travel when the elevator dual rate switch is set to the ON position. Its contents are the same as those of the aileron dual rate trimmer.

6 Pitch curve low side trimmer

This trimmer sets the low side throw of the pitch control servo when the throttle stick was operated.

7 Pitch curve high side trimmer

This trimmer sets the high side throw of the pitch control servo when the throttle stick was operated.

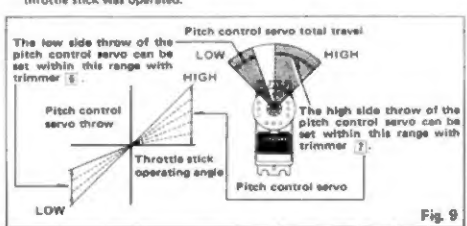


Fig. 9

8 Fail safe set switch

When memorizing the fail safe position of each servo at the transmitter, set this switch to the SET position.

Normally leave this switch in the NORMAL position.

9 Fail safe set button

This pushbutton switch is used when setting the fail safe servo position at the transmitter.

Fail Safe Setting

- When switch (8) is set to the SET position and this button is pressed, the positions of the servos the instant the button was pressed are memorized and sent to the receiver.
- Since this data can be sent automatically once every 60 seconds thereafter, this button does not have to be pressed at each flight.
- When this data is being transmitted, the monitor lamp goes out momentarily and transmission of the data can be confirmed.
- To prevent erroneous setting, set switch (8) to the NORMAL position at the end of one setting.
- When the receiver receives interfering signals or strong noise continuously, it enters the fail safe state and the servos move automatically to the positions previously memorized with the fail safe set button.
- When the noise or interference ceases, the fail safe function is reset automatically and operation can be continued.

A Inverted flight low-side trimmer

B Inverted flight high-side trimmer

C Inverted flight FS switch

INVERTED FLIGHT SPECIFICATIONS

- The inverted flight function can be turned on and off with the (C) inverted flight FS switch on the trimmer panel.
- INVERT: Inverted flight function ON
- INH: Inverted flight function OFF

- When the (C) switch is in the INVERT (function ON) position, normal flight → inverted flight switching can be performed with the (A) inverted flight ON-OFF switch at the front top corner of the transmitter.

- When the (A) switch is pulled back, normal flight is selected. At this time, the pitch can be adjusted with trimmers (6) and (7) as usual. When the (B) switch is pushed forward, inverted flight is selected. At this time, the pitch control servo, elevator servo, and rudder servo are reversed and the pitch control servo low-side and high-side throws can be adjusted with trimmer (A) and (B).

When the (C) inverted flight FS switch and (A) inverted flight ON-OFF switch are switched, the (A) inverted flight low-side trimmer and (B) inverted flight high-side trimmer operate the pitch control servo (servo connected to channel 6 of the receiver) as shown in the figure.

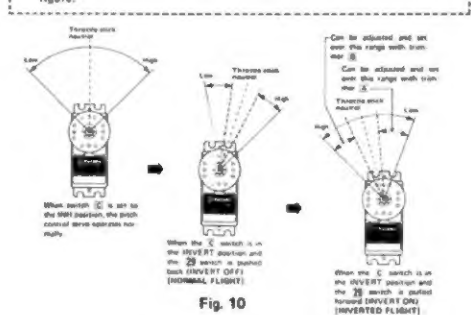


Fig. 10

PCM Proportional HOLD Function

- HOLD is a function which stops the servo at the correct position immediately before the erroneous signal was received when the receiver cannot receive the signal from the transmitter correctly for a short time.
- When the signal are received normally, normal operation can be resumed and flight is not disturbed. This is said to be the greatest feature of the PCM system.

PCM Proportional Fail Safe Function

- FAIL SAFE is a function which moves the servo of each channel (for example, engine slow, etc.) to a position preset on the transmitter when normal radio waves are not received by the receiver from the transmitter for a long time (one second or longer). (When not set, all the channels are set to neutral at fail safe.)
- When the direction of the transmitter antenna is changed or the interference disappears and normal radio waves are received, the fail safe state is released and operation can be resumed.

PCM Proportional Battery Fail Safe Function

- The battery fail safe function moves the throttle servo to a preset position as set by the fail safe function and alerts the operator to the danger when there is only a small amount of power left in the receiver NiCd battery. (If not set, the throttle servo will be set to medium slow automatically.)
- For a description of the battery fail safe setting method, see the fail safe setting method item.
- To release the battery fail safe of the stopped throttle servo, lower the throttle stick in the slow direction. When the throttle stick nears medium slow, battery fail safe is released and the throttle servo can be controlled for 36 seconds. Since battery fail safe will be set again after 36 seconds, quickly land the aircraft.

Servo reversing switches

- Using the servo reversing switches
- The left side of each switch is the normal position.
- The servo reversing switches reverse the direction of operation of the servos.

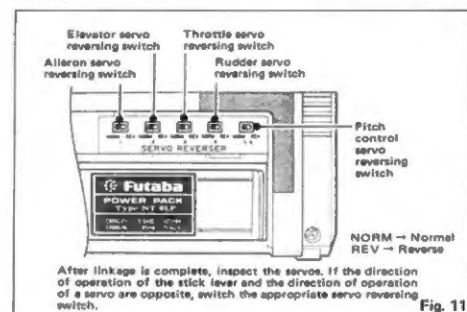


Fig. 11

After linkage is complete, inspect the servos. If the direction of operation of the stick lever and the direction of operation of a servo are opposite, switch the appropriate servo reversing switch.

Battery cover

Remove this cover when switching the servo reversing switches.

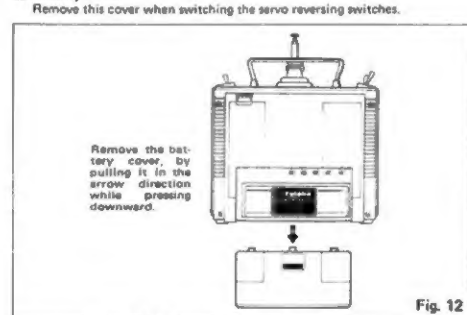
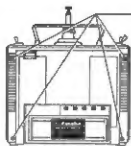


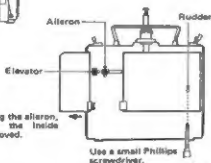
Fig. 12

The tension of the stick lever spring can be adjusted.



When these screws are removed, the back cover can be removed.

• The tension of the spring can be adjusted by removing the transmitter back cover and turning the screw for each stick. Set the springs for the best stick feel.



When adjusting the aileron, and elevator the inside module is removed.

Fig. 13

② Transmitter Nicad Battery NT-8LP

② Charging jack. Battery charge jack for built-in Nicad battery.

*CHARGING OF TRANSMITTER AND RECEIVER NI-CAD BATTERIES:

Recharge the receiver and transmitter Nicad batteries as shown in Fig. 14.

Notes:

- 1) First, connect to TX Nicad and red lamp goes on.
- 2) Then connect to RX Nicad after connecting. L, E, D, changes color from red to greenish red (orange) which indicates that both TX and RX Nicads are being charged.
- 3) In case of separate charging L, E, D, color will be: RX Nicad - Green, TX Nicad - Red.

AC-117V

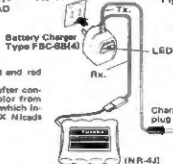


Fig. 14

- Connect the charging plug of the FBC-88 charge to the transmitter charging jack, connect the 3P connector of the FBC-88 to the receiver Nicad battery (NR-4J), and plug the FBC-88 to a 117VAC outlet as shown in this figure.
- The Receiver battery can be used about 10 times at 10 minutes per flight between rechargings.
- Charge the batteries for about 15 hours. When the set is not in use for some time, repeat discharge and charge two to three times before use. (If the batteries are not used for a long time, their capacity will go down).
- FBC-88 charges transmitter and receiver Nicad batteries independently or simultaneously.

RECEIVER FP-R116GP, SERVO FP-S128 (\$130, \$131S)

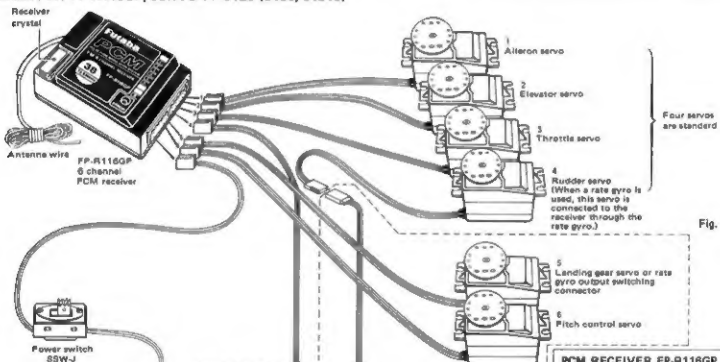


Fig. 15

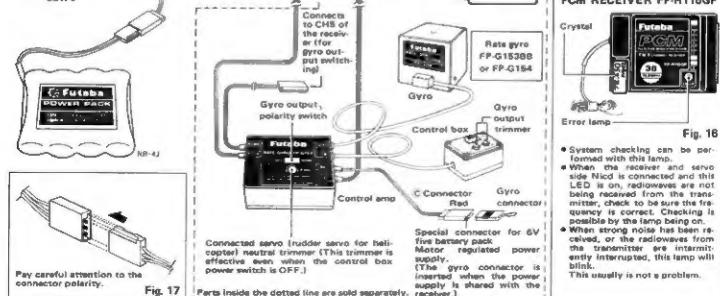


Fig. 17

PCM RECEIVER FP-R116GP

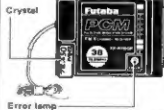


Fig. 16

- System checking can be performed with this lamp.
- When the receiver and servo side Nicad is connected and this LED is on, radiowaves are not being received from the transmitter, check to be sure the frequency is correct. Checking is possible by the lamp being on.
- When strong noise has been received, or the radiowaves from the transmitter are intermittently interrupted, this lamp will blink. This usually is not a problem.

Connected servo (rudder servo for helicopter) neutral trimmer (This trimmer is effective even when the control box power switch is OFF.)

Parts inside the dotted line are sold separately.

Special connector for 6V five battery pack. Motor regulated power supply. (The gyro connector is inserted when the power supply is shared with the receiver.)

PRECAUTIONS

- Connect the servos and switches as shown in the figure. Then extend the transmitter and receiver antennas fully.
- Set the transmitter power switch to ON. Then set the receiver power switch to ON. The servo stop near the neutral position. Operate the transmitter sticks and check that each servo follows the movement of the stick.
- Connect the pushrod to each servo horn and check if the direction of travel of each servo matches the direction of operation of its transmitter stick.
- Operate each servo over its full stroke and check if the pushrod binds or is loose. Applying unreasonable force to the servo horn will adversely affect the servo and quickly drain the battery. Always make the stroke of each control mechanism somewhat larger than the full stroke (including trim) of the servo horn. Adjust the servo horns so that they move smoothly even when the trim lever and stick are operated simultaneously in the same direction.
- Be alert for noise.
 - Touching of metal parts due to engine vibration, etc. will generate noise and cause the receiver servos to operate erroneously. We recommend the use of noiseless parts.
- When installing the switch harness, cut a rectangular hole somewhat larger than the full stroke of the switch and install the switch so that it moves smoothly from ON to OFF. This also applies to the switch mount when the switch is installed inside the fuselage and is turned on and off from the outside with a piece of wire, etc. Install the switch where it will not be exposed to engine oil, dust, etc.
- Even though the receiver antenna is long, do not cut or bundle it.



Fig. 18

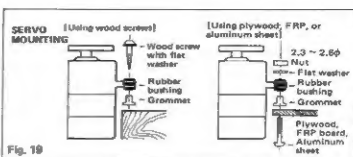


Fig. 19

- Install the servos securely. Refer to the figure.
- A spare horn is supplied. Use if needed.
- Wrap the receiver in sponge rubber. Waterproof and dustproof the receiver by placing it in a plastic bag and wrapping a rubber band around the open end of the bag. Do the same with the receiver and servo battery.
- Use the rubber bands wrapped around the receiver to hold the servo and switch leads.
- After mounting is complete, recheck each part, then check the range by making the transmitter antenna as short as possible, extending the receiver antenna fully, and operating the set from a distance of 20m to 30m. The movement of each servo should follow the movement of each transmitter stick.
- After mounting and checking are complete, take your model to the shop where you bought the digital proportional set, or to an experienced R/C operator and ask them to inspect your set-up and to teach you how to use your R/C set properly.

AIRCRAFT ADJUSTMENT

Make the linkages and adjustments described in the aircraft manufacturer's assembly instructions.

GENERAL AIRCRAFT ADJUSTMENT METHOD

These adjustments are for main rotor collective rotation. Set the revolution mixing direction switch 1 on the trimmer panel to the RIGHT position.

Revolution mixing

When the throttle (engine control) stick is set from the SLOW side to the HIGH side, the throttle servo operates as shown in Fig. 20A. If revolution mixing is applied at this time, the rudder servo operates with the throttle servo as shown in Fig. 20B. This throw is called the mixing amount. This rudder servo throw increases as the number of divisions of the scale increases. The rudder servo is operated as shown in Fig. 20B at the right rudder stick. However, if the throttle (engine control) stick is at SLOW, the neutral position is from the left and if the throttle (engine control) stick is at HIGH, the neutral position is from the right.

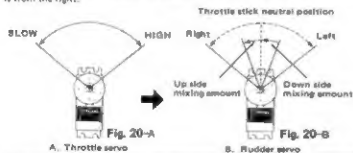


Fig. 20-A

Fig. 20-B

Revolution mixing adjustment

When the main rotor rotates, the aircraft attempts to turn in the opposite direction. To cancel this reaction torque, the pitch of the tail rotor (rudder) is increased. Revolution mixing performs this operation simultaneously with the throttle (engine control), and is necessary to fly a helicopter. (Operation is much easier if a rate gyro is used.)

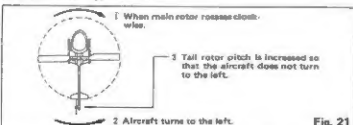


Fig. 21

- 1 Check the direction of operation of each servo. To reverse the direction of operation, switch the reversing switch.
- 2 Always set the idle-up switch 11 and throttle hold switch 15 to off (pushed to the opposite side).
- 3 Make the basic adjustments specified by the model helicopter manufacturer.

- 4 Check the left and right (up and down) throw of each servo. If the throw is incorrect, correct it by changing the position of the servo horn hole, etc.
- 5 Set the throttle stick 3 to about the center (medium slow) and install and link the servo horn at the neutral position.
- 6 Set the revolution mixing up side knob 14 to about division 5 and the revolution mixing down side knob 15 to about division 7.
- 7 Check the engine throttle linkage.
- Throttle opened fully at throttle stick HIGH (up).
- Throttle closed fully at throttle stick MAXIMUM SLOW (down).
- Use ATL (Adjustable Throttle Limiter) trim as much as possible. This is convenient because the HIGH side does not change even if the LOW side is changed. Then set the throttle stick to its full operating width and set so that the pitch control servo operates over its maximum travel.

For the main rotor variation width, select the servo horn position specified by the model manufacturer.

- 8 After starting the engine and adjusting the needle, hover and adjust the aileron and elevator trim. Next, make the main rotor pitch at hovering somewhat large with the aircraft linkage.
- 9 Adjust the aircraft linkage so that the rudder trim is neutral position.
- 10 After adjusting all the trimmer, adjust revolution mixing.
- 11 When the helicopter turns to the right while hovering after lift off, turn the revolution mixing down side knob clockwise. When the helicopter turns to the left, turn the knob counterclockwise.
- 12 When the helicopter turns to the left while rising from hovering, increase the mixing amount by turning the revolution mixing up side knob clockwise. When the helicopter turns to the right, reduce the mixing amount by turning the knob to counterclockwise.
- 13 Rate gyro output adjustment (when FF-G1638B is used)
A position about 40% to 80% of the rate gyro control box scale should be sufficient. (Differs somewhat with the model.)
If the tail of the helicopter whips back and forth, the gyro output should be increased.

• IDLE-UP ADJUSTMENT

When the idle-up switch is OFF, the throttle servo operates normally as shown in Fig. 22A. When the switch is ON and the idle-up trimmer 13 is set suitably, the throttle servo changes to the maximum slow position as shown in Fig. 22B.

When idle-up is used, hovering is stable and the rotor speed can be maintained even when the pitch is reduced during rolls and makes precise maneuvers are possible.

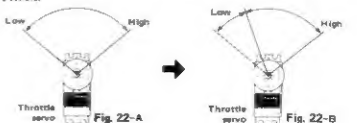


Fig. 22-A

Fig. 22-B

1. Get the transmitter throttle (engine control) stick to maximum slow and set the idle-up switch to ON and the idle-up trimmer to about 20% to 30%.
2. Next, set the idle-up switch to OFF, start the engine, hover, and decide the hovering speed.
3. Then set the idle-up switch to ON, hover, and adjust the idle-up trimmer so that the speed is about the same as, or somewhat slower than, the speed when the idle-up switch is OFF.
4. When the idle-up trimmer is turned clockwise, the speed increases. When starting the engine and after use, always set the idle-up switch to OFF.

●AILERON AND ELEVATOR DUAL RATE ADJUSTMENT

When the dual rate switch is set to ON, the servo throw is made smaller by the amount shown by the hatched lines in Fig. 23. The servo throw can be set from 40% to 100% of the full stroke by adjusting trimmer [A] or trimmer [B] on the trimmer panel with a Phillips screwdriver.

When the dual rate switch is set to OFF, dual rate is set and the throw becomes large.

- When the dual rate switch is OFF, adjust the servo horn and fuselage for the necessary throw. (When a large throw is necessary, such as for rolls, etc., fly with the dual rate switch set to OFF.)

- Set the dual rate switch to ON for level flight and adjust the trimmer for the required amount of throw. A throw of about 80% of the full stroke is good. (During hovering flights, fly with the dual rate switch set to ON.)

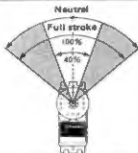


Fig. 23

●THROTTLE HOLD ADJUSTMENT

When the throttle hold switch is pulled forward, the throttle servo stops at the position set at the throttle hold trimmer [J]. Trimmer scale division 0 is minimum slow. Setting to the high side is possible as the number of division increases. When the throttle hold switch is OFF, the throttle servo is controlled by the transmitter throttle (engine control) stick. This device is used at auto rotation take off. After the engine is cut or at maximum slow (during practice), only the pitch control servo is operated (pitch up) and safe take off is possible.

1. Set the throttle (engine control) linkage so that the engine throttle is opened fully when the throttle (engine control) stick and throttle (engine control) trimmer are at maximum slow.
2. Set the throttle hold trimmer so that the engine throttle is that the engine throttle becomes maximum slow when the throttle hold switch is set to ON (switch pulled forward) at auto rotation practice.
3. When the throttle hold switch is set to OFF (pushed back), throttle (engine control) servo and pitch control servo mixing is performed. When the switch is set to ON, the throttle servo is held (maximum slow) by throttle trimmer or fully closed and only the pitch control servo operates.
4. When the hold switch was used at auto rotation take off, etc., always set the transmitter throttle stick to slow before setting the hold switch to OFF. Also check if the idle-up switch and throttle hold switch are set to OFF before starting the engine.

●PITCH CURVE TRIMMER ADJUSTMENT

The pitch of the main rotor differs with the weight of the fuselage, kind of engine, engine speed, etc. Since it can be adjusted at the transmitter, it is extremely convenient.

1. Set the pitch curve high side trimmer [7] to maximum pitch and the low side trimmer [8] to minimum pitch. (Set the trimmers so that the pitch control servo operates up to its maximum throw.)
2. Connect the linkage so that the main rotor pitch is double the angle specified by the model helicopter manufacturer at the high side (large pitch) and low side (small pitch).
3. Next, set the high and low sides to the pitch angle specified by the model helicopter manufacturer with the pitch curve trimmers.
4. High side adjustment
Fly at full speed. When the engine speed is high but the aircraft speed is not so fast, the pitch is insufficient. Therefore, increase the pitch with the high side trimmer. When the engine speed low, the plus pitch is excessive. Decrease the pitch angle. Adjust the main rotor pitch in this way so that the engine speed and aircraft speed are matched.
5. Low side adjustment
Climb to an altitude of about 30m and try auto rotation. (Throttle hold switch OFF) When the rotor speed drops, the minus pitch is insufficient. Therefore, lower the pitch with the low side trimmer. When the engine speed rises and the diving speed is fast, the minus pitch is excessive. Raise the pitch. Adjust the pitch so that the diving speed is slow, the rotor speed does not drop, and the two are matched for perfect descent into Auto-Rotation.

INVERTED FLIGHT PREPARATIONS

- When switching the rate gyro output, modify the set so that the output can be switched with the [5] CH5 switch (channel 5 of the receiver).
- Set the [6] inverted flight FS switch on the trimmer panel at the back of the set to the INVERT position.
- At this time, pitch control servo, elevator servo, and rudder servo forward → reverse switching can be performed with the [3] switch and normal → inverted flight switching can be performed.
- When the [3] switch is pushed forward (inverted flight function ON) when the [3] throttle stick is in the neutral (center) position, the neutral position of the pitch control servo moves to the plus side (pitch HIGH side at the panel).
- When connecting the linkage with the inverted flight specifications, always set the [5] switch to the INVERT position.
- Then adjust the set so that normal flight is normal.
- After adjusting normal flight, adjust inverted flight.
- Before flight, set the [3] switch to the forward position (inverted flight function ON) and set the throttle stick to maximum slow, then set the minimum pitch at inverted flight with the [A] trimmer.
- Next, set the throttle stick to maximum high and set the maximum pitch at inverted flight with the [B] trimmer.
- The [A] and [B] trimmers can be adjusted only when the [3] switch is in the forward (inverted flight function ON) position.

FLIGHT

- Perform normal flight and adjust the pitch.
- After adjustment, switch from normal flight to inverted flight.
- There are various methods of changing from normal flight to inverted flight. One method is to enter inverted flight by making a half roll from straight flight.
- First, make a half roll from straight horizontal flight at an altitude of about 30m and when the helicopter is exactly on its back, turn on the inverted flight function by pulling the [3] switch forward.
- If the throttle stick remain high at this time, the posture of the helicopter will change suddenly. Shifting to inverted flight can be performed smoothly by lowering the throttle stick to about medium slow.
- Learn the [3] switch's switching timing, throttle stick operating setting, etc. by practicing normal flight → inverted flight switching repeatedly.
- Next, switch from inverted straight flight to inverted hovering.
- Lower the altitude by slowly lowering the throttle stick.
- At this time, when the helicopter descends sluggishly and the main rotor speed drops even when the throttle stick is lowered, return to normal flight, then land and lower the lower pitch of the main rotor at inverted flight with the [A] trimmer.
- Finally, check the high side pitch.
- Try setting the throttle stick to maximum high at inverted hovering.
- If the main rotor speed drops at this time, lower the high side pitch with the [B] trimmer.

An inverted flight ON/OFF switch is provided. The pitch control, elevator, and rudder servos are reversed for inverted flight when this switch is set to ON, inverted flight is then extremely easy.

USING THE ANTENNA FREQUENCY FLAG

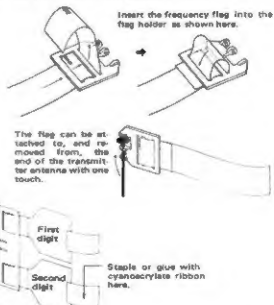


Fig. 24

SPLINED HORNS

This horn permits shifting of the servo neutral position at the servo horn. Setting and shifting the neutral position

a) Angle division

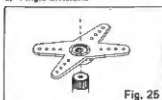


Fig. 25

- 1) The splined horn has 25 segments. The amount of change per segment is: $360 \div 25 = 14.4^\circ$
- 2) The minimum adjustable angle is determined by the number of arms or number of the holes. For four arms, the minimum adjustable angle is:

$$360^\circ \div \frac{(25 \times 4)}{\text{Number of divisions}} = 3.6^\circ$$

b) Effect

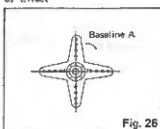


Fig. 26

To shift the holes center line to the right (clockwise) relative to baseline A, shift arm 2 to the position of arm 1 and set it to the position closest to baseline A.

[Example] For a four-arm horn, the angular shift per segment is 14.4° . The shift to the right is $90^\circ \div (14.4 \times 6) = 3.6^\circ$

To shift by the same angle in the opposite direction, use the opposite arm number.

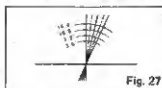


Fig. 27

For a six-arm horn, turn the arm counterclockwise and set arm 2 to the position of arm 1. The adjustable angle is $60^\circ \div (14.4 \times 4) = 2.4^\circ$

Arm 3 shifts 4.8° to the right, arm 6 shifts 2.4° to the left, and arm 4 shifts 7.2° to the right and left.

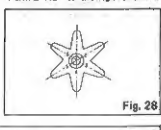


Fig. 28

The following splined horns are optional.

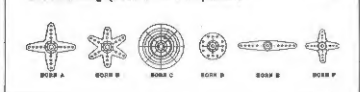


Fig. 29

FP-S128

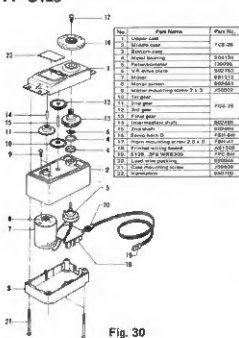


Fig. 30

FP-S130

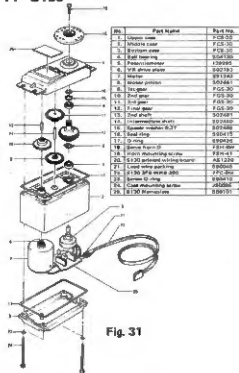


Fig. 31

FP-S131S

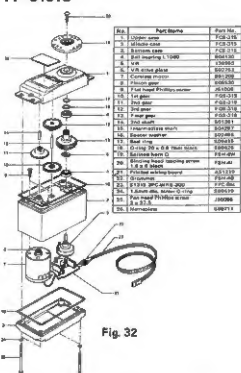


Fig. 32

WORLD SALES & SERVICE FACILITIES

To insure prompt service, please follow the instructions given below.

1. Charge the batteries for at least 10 hours prior to shipment.
2. Return the system only. Do not attempt installation. Remove the servos from their mounts and remove the foam padding from the receiver.
3. Plug or other modifications which interfere with factory seal procedures will be returned to factory standard at your expense.
4. Carefully pack all components individually, using sufficient packing material to prevent damage during shipment.
5. Include a brief but thorough explanation of all problems and service required and tape it to the back of the transmitter. Place a label describing the function of the servo on each servo.
6. Be sure to include your full address and tel. No., zip code inside the box as well as on the outside.
7. Include a packing list of all items being returned, and double check to make sure they are all items are packed.
8. Upon receipt of your equipment at the Futaba factory, an estimate of the cost of repair (over \$25.00 only) will be sent to you. Your equipment will then be repaired and returned to you upon receipt of payment or C.O.D. (cash).

This factory repair service applies only to the continental U.S.A., Hawaii, and Alaska.

FACTORY REPAIR SERVICE

Australia:	FUTABA SALES AUSTRALIA PTY. LTD., MELBOURNE, VIC. 3121-4786	Latvian:	KHARALLAH MODELFACT, BEFFORT TEL: 206-881
Argentina:	MODELSMO AERONAUTICO DEGA SRL, BUENOS AIRES TEL: 262-2288	New Zealand:	AMALGAMATED WIRELESS AUSTRIALIA N.Z. LTD. WELLINGTON TEL: 56-070
Canada:	UDISCO LTD. MONTREAL TEL: 481-8100	Hong Kong:	HOBBY LAND, 200 A/S. Drummien TEL: 500 83 30 70
Chile:	HOBBY LANDIA, SANTIAGO TEL: 24-6037	Singapore:	SINGAPORE HOBBY SUPPLIES TEL: 833-0332
Denmark:	FUTABA IMPORT DENMARK, COPENHAGEN TEL: 02-81-0109	South Africa:	REDWAX PTY. LTD. JOHANNESBURG TEL: 21 1811
England:	RIPMAN LIMITED, LONDON TEL: 01-8048272	Spain:	HOBBY & TOY INTERNATIONAL, VALENCIA, 461 367 2293
Finland:	NORSTON (KY, FINLAND) TEL: 30-438069	Sweden:	NORD CONTROL CENTER, JONKOPING TEL: 500-8862
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Germany:	RADAR CO. LTD. TEL: 3-480057	Switzerland:	ROBE MOULDERPORT GmbH, GERSCHENAU TEL: 00844-870
Hong Kong:	RADIOSETTE, SRI Lanka TEL: 500-044 FORTIN 1		
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